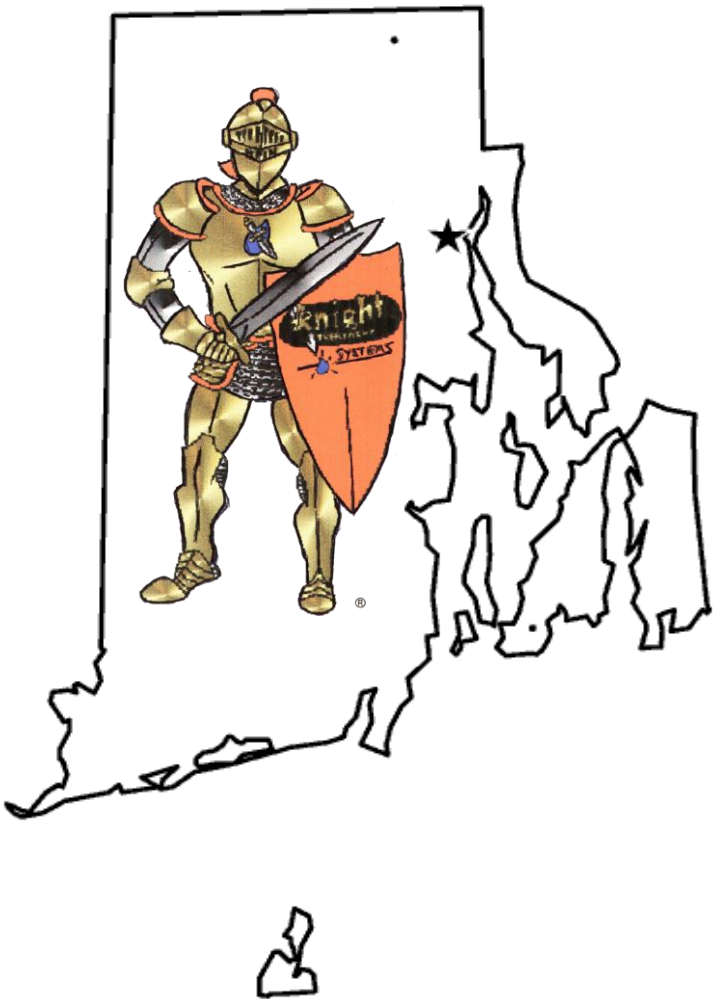
White Knight Microbial Inoculator Generator™

US Patent 7658851



Design, Installation, Operation & Service Manual

For the

State of Rhode Island

June 2020

Guardians of Water Quality™

281 County Route 51a, Oswego, NY. 13126

1-800-560-2454

www.knighttreatment.com

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(I) INTRODUCTION

The Enhanced Biological Augmentation of Onsite Wastewater Treatment Systems is the methodology of introducing a group of task specific selected microorganisms though inoculums in tandem with a microbial inoculation generation device that is placed into an onsite wastewater treatment train, typically the septic tank, to significantly improve overall treatment system performance, rehabilitate dysfunctional systems and assure system longevity.

The White Knight Microbial Inoculator Generator™ (MIG) continuously inoculates a septic tank or other treatment vessel with naturally occurring selected strains of non-pathogenic bacteria selected for their ability to metabolize organic material. Continuous inoculation is mediated through in-situ cultivation of IOS-500™ inoculums. Through airlift mixing, recirculation, and fine bubble aeration principles the device brings the selected bacteria into contact with fixed film substrate and the suspended organic compounds in a septic tank, or other process treatment vessel. The introduced cultures of bacteria grow at logarithmic rates as they voraciously digest most of the organic pollutants that are found in the wastewater and the organic waste compounds that have been transferred to the soil.

The fine bubble driven airlift features of the White Knight Microbial Inoculator Generator™ are designed to allow for more efficient transfer of oxygen and low maintenance, high rate circulation of wastewater through the device, and across the fixed film media. An abundant oxygen supply supports the introduced IOS-500™ bacterial cultures providing for more rapid digestion. The tubular configuration internal media is clog resistant and provides for uninterrupted flow across abundant surface area for the establishment of the selected fixed-film culture.

Many of the natural bacteria found in wastewater such as the coliform group are not as aggressive at decomposition of the organic compounds found in wastewater and cannot compete with the IOS-500™ introduced cultures. The tank serves as the breeding reactor that cultivates and releases the bacteria that are carried by the effluent stream out to the soil enhancing its treatment capabilities and hydraulic functionality.

(II) WHITE KNIGHT MIG™ MANUFACTURER'S SPECIFICATIONS:

White Knight Microbial Inoculation Generation™ (MIG) Device:

1. The MIG device itself is manufactured from a rotationally molded single piece HDPE outer plastic housing.

2. The MIG device's housing has an internally partitioned ballast area in the base of the unit that is easily filled with pea stone ballast in the field..

3. The internal ballast partition shall serve as the primary anchoring member for the fine bubble diffusion mechanism.

4. The internal fixed film media consists of a tubular clog resistant configuration that allows for the in service cleaning of the fine bubble diffusion membrane without disassembly of the MIG or requiring its removal from the tank.

5. The location of the IOS-500™ inoculant shall be in the vertical path of flow just above the fixed film media of the MIG and in contact with the flow stream while in operation.

Air Supply:

1. Air is supplied to the MIG by an external 115-volt AC single-phase linear air pump supplied by Knight Treatment Systems, Inc.

2. The supplied Control Panel shall be UL listed, equipped with an audio / visual alarm system that senses the loss of air pressure and optional high water sensing contacts in a NEMA 4X enclosure with a pump run elapsed time meter.

3. Air supply pumps may be located in either an outdoor weather resistant enclosure or in an indoor protected area.

4. All relevant electrical work must comply with the appropriate electrical codes.

5. Air supply lines shall be installed in such a manner that provides protection from damage due to frost heave, vehicular and/or foot traffic.

Deployment:

1. MIG installation shall only be performed by a manufacturer's trained and certified provider in conformance with the manufacturer's guidelines and under the appropriate regulatory requirements.

2. The MIG shall only be placed in structurally sound watertight septic tanks. The MIG must not be installed in cesspools, block, steel, or other substandard tanks or in any septic tank of volume less than 1,000 gallons.

3. The septic tank shall provide for a minimum of 1.5 days residency time of the total estimated daily flow of wastewater from the property and in any situation no less than 1,000 gallons in volume.

4. The outlet of the septic tank must be equipped with a RI approved effluent filter.

5. The septic tank must have service risers meeting Rhode Island regulatory requirements, to facilitate monitoring and maintenance.

6. The subsurface effluent dispersal system must be of appropriate size to handle the daily flow from the property being served when functioning properly.

Service & Warranty:

1. A manufacturer's component warranty program shall be provided to the property owner for each MIG installed.

2. A comprehensive service program shall be provided to the property owner for each MIG installed.

3. Service of the MIG shall only be conducted by manufacturer trained and authorized providers in compliance with regulatory requirements and at a minimum of 6-month intervals.

4. A minimum initial two-year Operation & Maintenance (O & M) contract shall be provided with each unit installed.

5. A valid O & M contract shall be in place for the life of the MIG.

Accepted MIG & Manufacturer:

1. " White Knight Microbial Inoculator Generator™"
   Knight Treatment Systems, Inc.
   281 County Route 51A
   Oswego, NY 13126
   1-800-560-2454

Accepted Inoculum:

1. "IOS-500™"
   International Wastewater Solutions, Inc.
   PO Box 157
   Sebastopol, CA 95473
   707-887-1811

(III) White Knight MIG™ Technical Information & Drawings

Model Specifications:

Model #	BOD loading	# of Columns per Model	Size of Column (dia" x height")	Minimum Main Feed Air Pipe ID	Minimum recommended tank size	Approximate Diffuser Air Flow (CFM) @ 2 PSI
WK40	up to 300 mg/L @ 500 gpd	1	16" dia. x 27.5" tall	½"	1000 Gal	1.5 CFM
WK78	up to 300 mg/L @ 1000 gpd	2	16" dia. x 27.5" tall	¾"	1500 Gal	3 CFM
WK150	up to 800 mg/L @ 1000 gpd	3	16" dia. x 27.5" tall	¾"	3000 Gal	7 CFM
WK200	up to 800 mg/L @ 2000 gpd	4	16" dia. x 27.5" tall	¾"	4000 Gal	9 CFM

Individual Model Application Guidelines:

1. Model WK40: 1 to 4 total bedrooms based on minimum 1.5 day residency time of average daily flow within pretreatment tank.

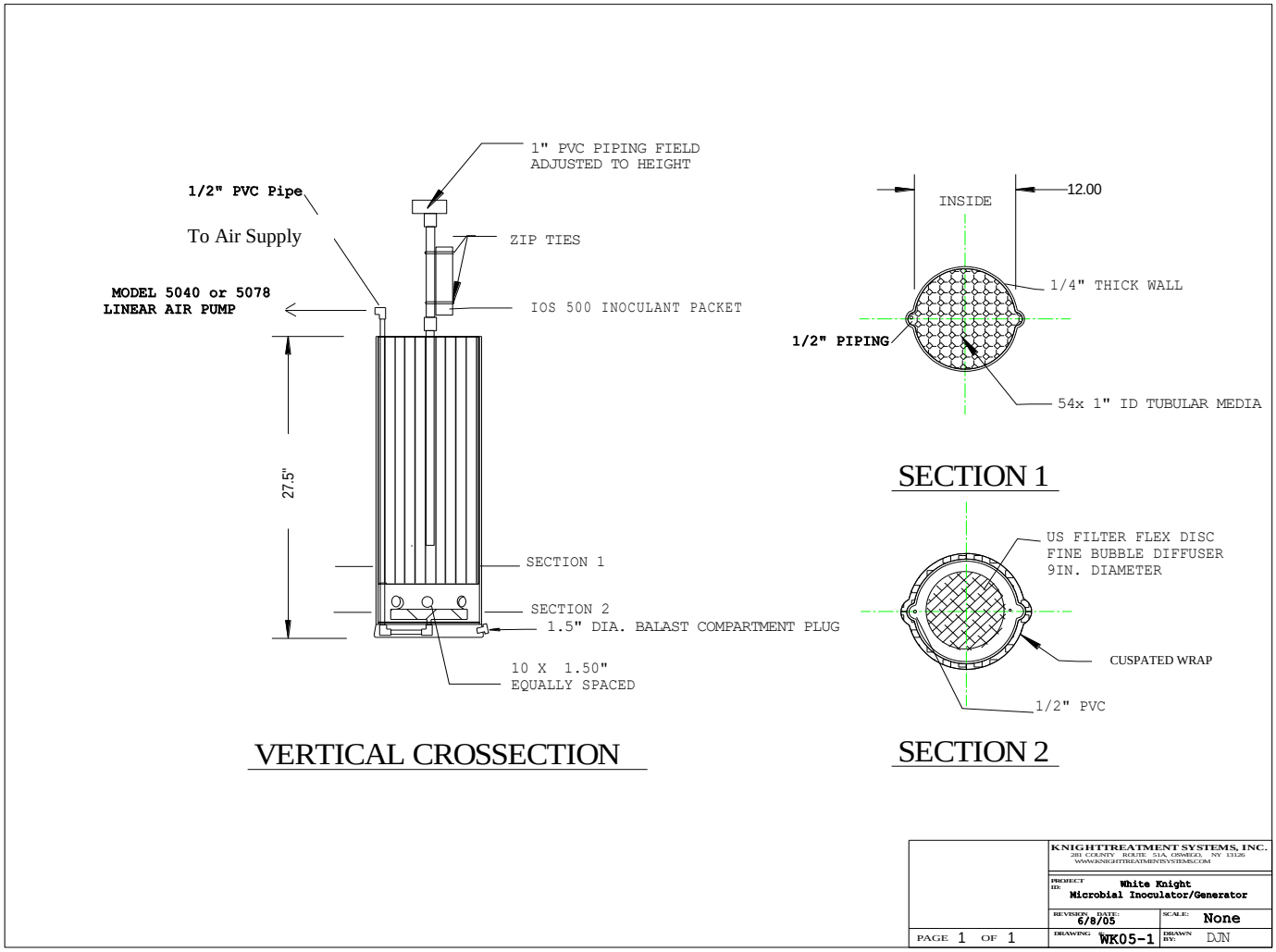
2. Model WK78: up to 8 total bedrooms or small commercial system with <1000 gpd and a BOD value of <300 mg/L based on minimum 1.5 day residency time of average daily flow within pretreatment tank.

3. Model WK150: Multi-Residential, Commercial or Institutional System with <1000 gpd and a BOD value of <800 mg/L based on minimum 2 day residency time of average daily flow within pretreatment tank.

4. Model WK200: Multi-Residential, Commercial or Institutional System with <2000 gpd and a BOD value of <800 mg/L based on minimum 2 day residency time of average daily flow within pretreatment tank.

5. Note: Multiple Models can be combined to address greater hydraulic and organic loadings for a specific project. Contact Knight Treatment Systems for technical guidance.

White Knight MIG™ Column Drawing



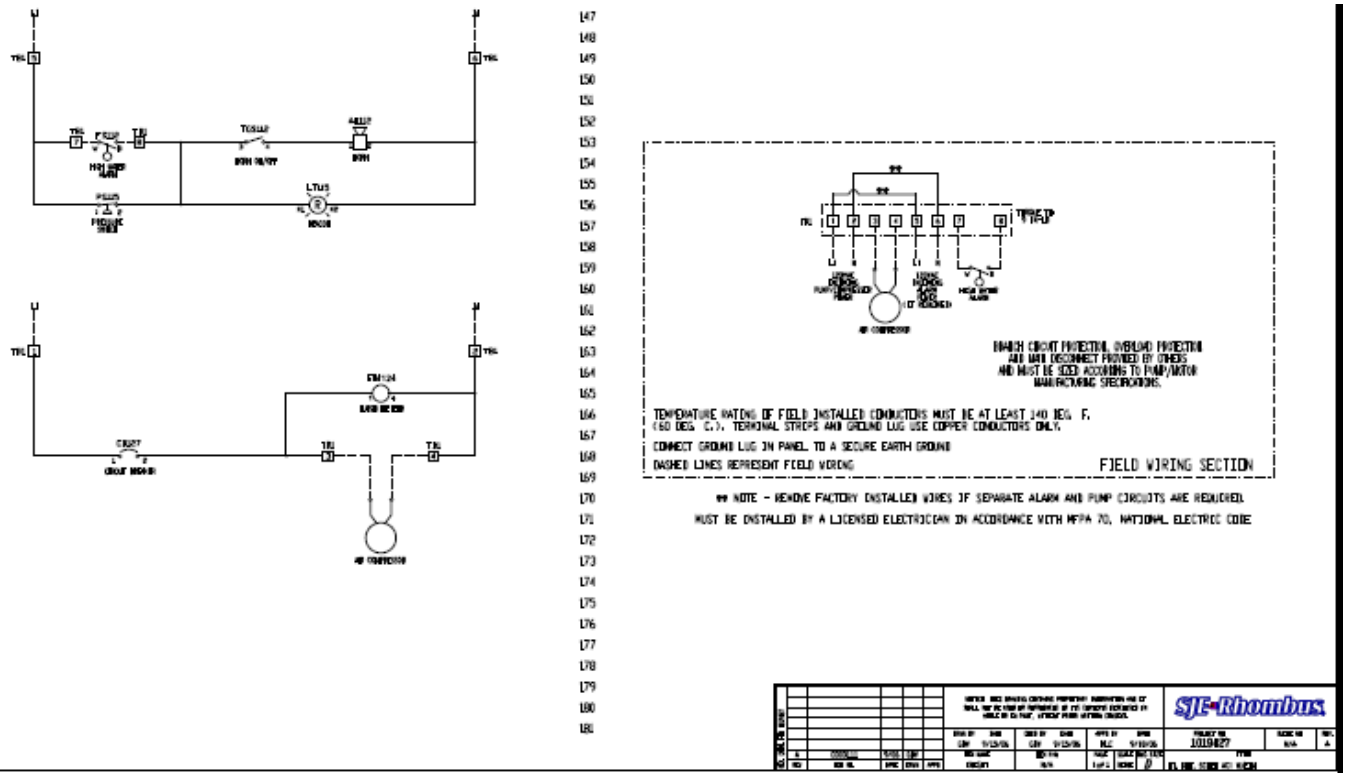
Air Supply Specifications:

Model #	Minimum Output @ 2 psi (CFM)	Maximum Air Pump Sound Level @ 3′	Amps	Volts
WK40	1.5	32 dBA	.8	120 AC
WK78	3	36 dBA	1.6	120 AC
WK150	7	48 dBA	2.1	120 AC
WK200	9	47 dBA	3.4	120 AC

UL Listed Alarm/Control Minimum Specifications:

Model #	Voltage	Amps Max	Failure sensing	Alarm Type	Overload protection (amps)	Switching
All Models	120 AC	15	Pressure drop +/or float	Visual & Audible	15	Normal/ Silence only

Alarm/Control Field Wiring Diagram:



White Knight MIG™ Aeration Calculations:

Pretreatment for Downsizing of Dispersal Systems: Reduce the anticipated BOD load at a peak design flow to a 30 day average of 30 mg/L or less per day BOD for application of the pretreated wastewater effluent to a reduced in size soil based dispersal and polishing system by incorporating an appropriately rated White Knight MIG™ within adequately sized treatment vessel; Residential Strength minimum 1.5 day residency time with 2 day residency time preferred.

Model WK40: Individual Residential Systems w/ BOD of 300 mg/L or less at 500 GPD

- 300 mg/L BOD @ 500 GPD = 1.251 # BOD
- 30 mg/L BOD @ 500 GPD = .1251 # BOD
- Need 1.125 # BOD reduction
- Use 1.2 # O2 required per # BOD thus 1.125 # BOD x 1.2# O2 = 1.35 # O2 required
- 1 SCFM Air = .0018 # O2 per minute @ 10.5%fine bubble O2 transfer efficiency.
- White Knight MIG WK40 Output: 1.5 SCFM Total (HP-40 Air Pump @ 2 PSI) = .0027 # O2 x 1440 min/day = 3.88 # O2 per day.

Model WK78: Large Residential & Small Commercial Systems w/ BOD of 300 mg/L or less at 1000 GPD

- 300 mg/L BOD @ 1000 GPD = 2.502 # BOD
- 30 mg/L BOD @ 1000 GPD = .2502 # BOD
- Need 2.2518 # BOD reduction
- Use 1.2 # O2 required per # BOD thus 2.2518# BOD x 1.2# O2 = 2.702 # O2 required
- 1 SCFM Air = .0018 # O2 per minute @ 10.5%fine bubble O2 transfer efficiency.
- White Knight MIG WK78 Output: 3 SCFM Total (HP-80 Air Pump @ 2 PSI) = .0054 # O2 x 1440 min/day = 7.776 # O2 per day.

Model WK150: Institutional & Commercial Systems w/ BOD of 800 mg/L at 1000 GPD

- 800 mg/L BOD @ 1000 GPD = 6.627 # BOD
- 30 mg/L BOD @ 1000 GPD = .2502 # BOD
- Need 6.4218 # BOD reduction
- Use 1.2 # O2 required per # BOD thus 6.4218# BOD x 1.2# O2 = 7.70616 # O2 required
- 1 SCFM Air = .0018 # O2 per minute @ 10.5%fine bubble O2 transfer efficiency.
- White Knight MIG WK150 Output: 6.9 SCFM Total (HP-150 Air Pump @ 2 PSI) = .01242 # O2 x 1440 min/day = 17.8848# O2 per day.

Model WK200: Institutional & Commercial Systems w/ BOD of 800 mg/L at 2000 GPD

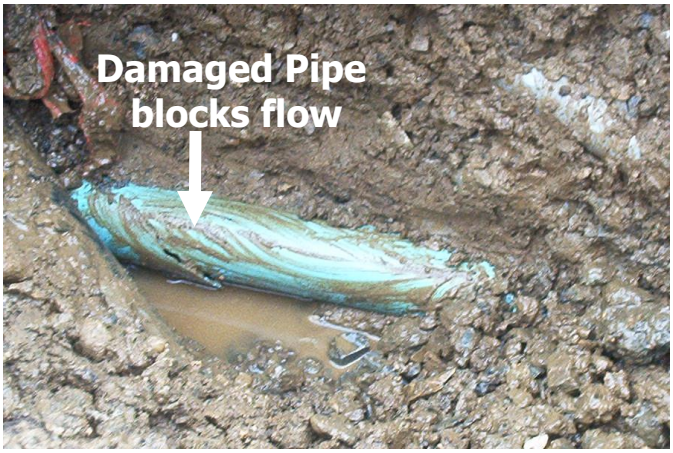
- 800 mg/L BOD @ 2000 GPD = 13.34 # BOD
- 30 mg/L BOD @ 2000 GPD = .504 # BOD
- Need 12.836 # BOD reduction
- Use 1.2 # O2 required per # BOD thus 12.836# BOD x 1.2# O2 = 15.4032# O2 required
- 1 SCFM Air = .0018 # O2 per minute @ 10.5%fine bubble O2 transfer efficiency.
- White Knight MIG WK200 Output: 9 SCFM Total (HP-200 Air Pump @ 2 PSI) = .0162 # O2 x 1440 min/day = 23.328# O2 per day.

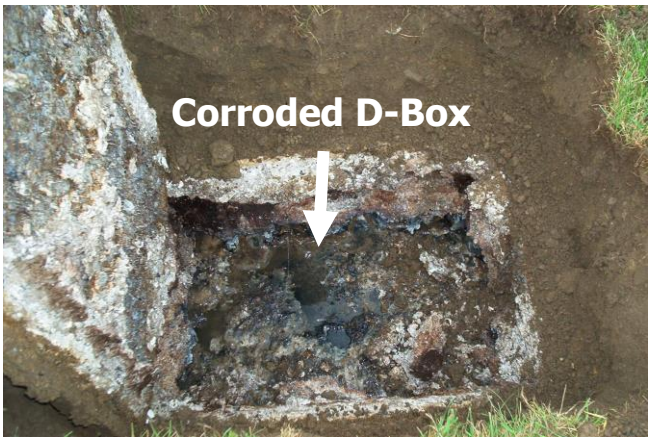
Note: Multiple WK MIG™ units can be configured into an appropriately sized treatment train that is capable of handling a variety of flow and BOD loadings. Call our office for assistance.

(IV) White Knight MIG™ Remedial Site Qualification

The White Knight Microbial Inoculator Generator's™ remedial success is directly linked to the proper determination of the root cause of an onsite system's dysfunction. In order to determine whether or not the dysfunctional system is a candidate for enhanced biological rehabilitation a thorough site evaluation must be performed. To this end a KTS Certified Dealer shall perform a comprehensive site evaluation and owner/operator interview to determine the actual nature of the problem(s) being experienced.

The system's infrastructure must be sound and free of defect. Septic tanks, distribution boxes and other components must be evaluated and repaired or replaced if found to be damaged or deficient. Leachfields constructed of antiquated materials such as "Orangeburg Pipe" and/or "Wooden Plank Trenches" should be replaced. All such repairs must be performed under an approved repair permit and may be incorporated in the repair application in which installation of the White Knight MIG™ is specified.





Surface water runoff infiltrating the system will have a major impact on the hydraulic performance and treatment efficiency of the absorption system contributing to its dysfunction.

Sources of concentrated flow from impermeable areas such as rooftops and driveways must be identified and directed away from system components. Visiting a dysfunctional system during or shortly after a significant rain event can be invaluable tool in assessing the drainage patterns of the property.

Inflows from leaky plumbing fixtures place a tremendous burden on the absorption system. Water continuously trickling into the septic tank is a positive sign that either inflow and/or infiltration are taking place.

Illicit discharge from sump pumps into the system may also be a contributing factor. Condensate from heating / air conditioning appliances and water softener backwash have been demonstrated to impact the processes of wastewater treatment systems. Conduct an in the home survey of all water using fixtures and any sump pump connections in the presence of the property owner and identify the appropriate corrective measures that would need to be taken.

The physical verification of the existence of a clogging mat is an important evaluation practice. Typically the upslope edge of the absorption system is located with a probe and a small excavation is created in close proximity above the system to a depth below the bottom of the absorption system.

Depth to ground water and its movement plays a major role in the functionality of an absorption system and its ability to treat wastewater. The hydrology of a lot can be impacted and dramatically change from the time of original system siting due to neighboring development. In such a situation the installation of a swale, curtain or perimeter drain may become a necessity to keep the absorption from becoming saturated.

Once the excavation is made and ground water is not encountered the excavation is moved towards the absorption system's soil interface to establish the presence of the clogging mat. Typically the internal hydrostatic pressures of the absorption system will breach the clog mat and fill the hole with effluent. The thickness of a clog mat will vary and is dependant upon soil structure and texture. Loose granular soils exhibit a thicker and more pronounced appearance than tighter soils. When ground water is encountered consult with the appropriate regulatory authority for direction.

(V) White Knight MIG™ Residential Site Qualification Form

Date _____

Name _____ Home ( ) _____-_____

Address _____ Office ( ) _____-_____
(Location of System)

Town/City _____ Mobile ( ) _____-_____
(Location of System)

State _____ Zip _____ E-mail _____
(Location of System)

Mailing address of System owner/operator if different from above:

_____

_____

Description/Directions _____

_____

_____

Regulatory Authority

Agency _____ Office ( ) _____-_____

Address _____ FAX ( ) _____-_____

Town/City _____ Mobile ( ) _____-_____

State _____ Zip _____ E-mail _____

Permit Number _____ Date of Issuance _____

Contact Person _____

Plans / Permit Available? **Y N**

Qualifying Interview

Septic System

Type of System _____

Age of system _____ Plan available **Y N** Date last pumped _____

Septic tank size _____ Tank Material **Concrete** **Plastic** **Metal**

Pump chamber **Y N** Distribution box **Y N Unk**

Leachfield type & size

PVC/stone___ Plastic Chambers___ Concrete Chambers___ Seepage Pit___

Other (specify) _____

Prior attempts to fix system **Y N** If yes, what and when _____

_____

_____

_____

Permit numbers for prior repair work performed _____

Building

Type of use

Residential

How long have you lived in this home? ____ years

Single Family ____ # Bedrooms ____ # Bathrooms ____

Garbage Disposal Unit? **Y N** Hot tub, spa, whirlpool bath? **Y N**

Water Supply? **Well** **Municipal**

If well, does a water purification/softener backwash discharge into septic system? **Y N**

Does the property have a sump pump? **Y N** Discharge into septic system? **Y N**

Laundry discharge into septic system? **Y N** Laundry detergent? **Liquid Powder**

Describe Laundry & Cleaning Habits (products used and how often):

_____

_____

_____

Have any bedrooms been added since installation of original septic system **Y #___ N**

Has usage of property changed since installation of original septic system? **Y N**

If yes, describe changes. _____

Trouble Symptoms

Drain back-up ___ Visible effluent ____ Evidence of Previous Breakout _____

Lush vegetation ____ High tank level ____ Liquid Level in Tank Above Outlet Invert _____

Odor ____ Frequent Pumping ___ Other _____

Site Visit

Date: Time: _____

Septic tank size _____ Tank Material _____

Tank Condition (observed following pumping) _____

Inlet Access Y N Center Access **Y N** Discharge Access **Y N**

Date of Pump Out & Name of Pumper _____

Depth of tank from inside bottom to outlet invert _____ Depth of soil cover over tank _____

Baffle condition _____ Discharge effluent level _____" above invert

Septic Tank Discharge pipe description

_____

Ponded Effluent level in leach field/trenches _____

Biological clogging confirmed **Y N**

Soil Type & Description _____

Observed Depth to Ground Water _____ Storm Water / Snow Melt Infiltration? **Y** **N**

Apparent structural damage or other unusual findings_____

_____

Provide sketch of system layout and cross section of absorption system below. Please indicate all breakout points, boundaries and depth of ponded effluent within system.

Installation Requirements

Length of airline run _____ft Length of electrical run _____ft

Jet Lines **Y** **N** Baffle removal required for Effluent Filter Installation? **Y** **N**

Tank requires service riser(s) & covers? **Y** **N** Tank is: Concrete___ Plastic____

Depth of tank top from finished grade _____in. Need _____in. of riser

Distribution line or other modifications needed:

_____

_____

Does System qualify for White Knight? **Y** **N**

Additional Repair Permits Required? Y N

Evaluation Performed By: _____

(VI <u>Installing the White Knight MIG™</u>

Important Note: The following directions are provided with the assumption that those involved with the installation of the White Knight Microbial Inoculator Generator hold knowledge of, adhere to, practice and promote the protection of the health and safety of their colleagues, the public and the environment. Becoming educated in and complying with all Industry and OSHA Safety Requirements and governing Regulatory Requirements is the sole responsibility of the installer. Knight Treatment Systems, Inc. assumes no risk or liability for any omissions or actions of the installer or by others associated with the installation.

1) Expose the top of septic tank. An approved riser system must be used where absent at the location where the White Knight™ will be installed and at the outlet of the septic tank for effluent filter servicing. The minimum diameter of the opening for the White Knight must be 18 inches.

2) It may be necessary to modify the tank to accommodate installation of the White Knight™ and/or the effluent filter. When required and acceptable with the tank's manufacturer, modify or create the appropriate access opening in a safe manner. All risers should be installed watertight and extend just above finished grade. Lids should conform to RI regulatory requirements and prevent unauthorized entry.

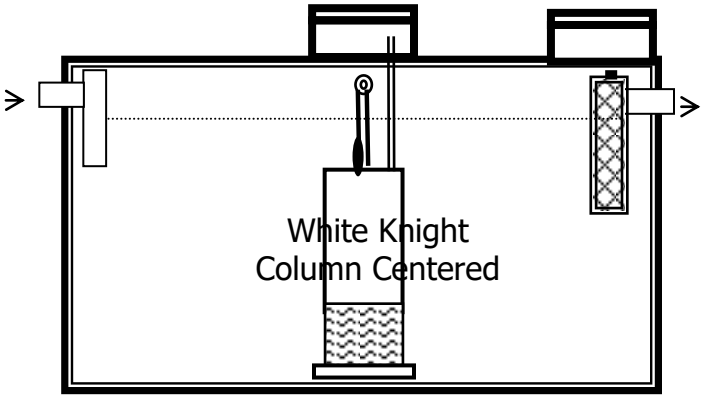
3) The tank must be pumped and ALL solids removed prior to installation of the White Knight™. The absorption system must also be drained of ponded effluent. This can be accomplished via access gained at the Distribution Box, existing monitoring port or by excavating at the lowest point of the absorption system and pumping out the ponded effluent. Install a monitoring port prior to back filling.

IMPORTANT NOTE: Lines containing settled sludge must be jetted.

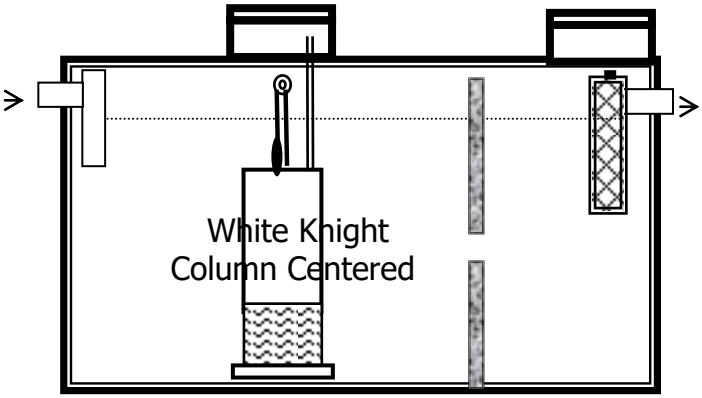
Ponded Effluent Removal from Distribution Box

Ponded Effluent Removal from Leachfield

4) The preferred location for the White Knight™ is in the center of a single compartment tank or centered in the first compartment of a two-compartment tank as illustrated by the diagrams below.



Single Compartment Tank



Dual Compartment Tank

5) The optimum depth for the bottom of the White Knight™ is 4 feet below the surface of the liquid in the tank. When tanks are encountered with liquid operating depths greater than 5 feet elevate the White Knight™ to the optimum depth. Utilizing 6 stainless steel 1.5" long screws securely fasten an inverted 5-gallon plastic bucket to the bottom of the tower with holes created in the base of the bucket to prevent floatation. Trim sides of the inverted bucket to achieve the optimum depth. For tanks with depths greater than 6 feet suspending the White Knight from the riser is also an acceptable practice.

<u>CAUTON:</u> NEVER ENTER A SEPTIC TANK OR OTHER CONFINED SPACE WITHOUT FOLLOWING OHSA REQUIREMENTS & PROCEEDURES!

6) Ballast must be added to the White Knight prior to its placement into the tank. Locate the plug near the base of the tower and completely fill ballast compartment with pea stone replacing plug when completed.

7) A RI approved effluent filter is required. When absent install an appropriate effluent filter and service riser system at the outlet of tank. Failure to install an effluent filter will result in voiding of Supplier's performance warranty.

8) The locations for the Alarm Panel and Air Pump Basin should facilitate running of airline to the White Knight riser and the related electrical connections for the panel and air pump. The location should shield the basin from direct sunlight and weather events in so much as possible. Air Pump Basins should be slightly elevated when flooding is a possibility and always placed on a 2" bed of washed gravel to facilitate drainage. Drill airline entry hole in bottom of basin over sizing the penetration to allow for the drainage of any water that may find its way into the basin.

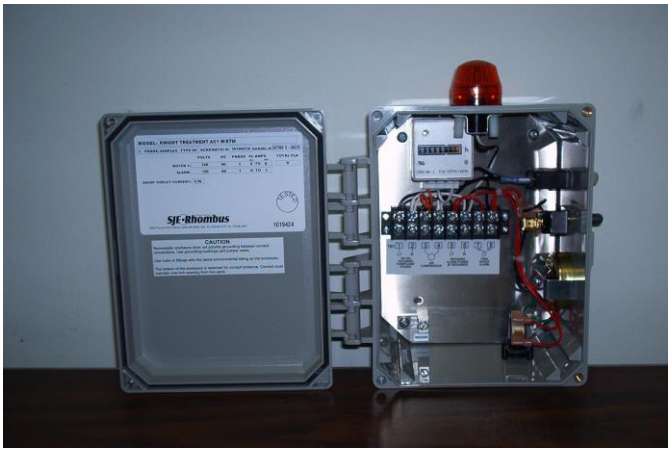
9) A trench must be provided for the air supply line between the Air Pump location and the White Knight service riser. Excavation may be accomplished either by hand or with the use of power equipment. Trench should uniformly slope from the air pump location to the service riser to prevent any airline condensate from pooling. When performing an excavation makes sure you are in compliance with local procedure and safety practices with regard to the protection of under ground utilities. **NOTE: Where an airline must cross vehicle traffic or parking areas such as a driveway the air supply line should be protected by placing it in a sleeve such as a 1" ID Schedule 80 PVC pipe installed a minimum of 12" below the surface of the traffic area.**

10) The air supply line can be either Schedule 40 PVC, PEX or HDPE piping, ½" ID minimum, ¾" is preferred. HDPE or PEX piping is recommended as it reduces the amount of connections to be made minimizing the potential for air leaks.

11) Place a 2"x8"x16" cinder or patio block in basin as a base for the Air Pump. Install airline through bottom of basin. Install the pressure-sensing tap near the Air Pump into the airline making the appropriate transitions in making the connections.

12) Indoor air pump locations may create service complications due to lack of accessibility during property owner or tenant absences and should be avoided if possible. When indoor installation is necessary, locate air pumps in an easily accessible area of the building's basement, garage or a utility room on a stable base.

13) After positioning air pump, have an electrical contractor or qualified electrician, having obtained all necessary permits; connect the alarm panel and air pump according to the National Electrical Code, any applicable local codes, and in compliance with wiring diagram provided by Control / Alarm panel manufacturer. Do not turn on electricity at this point.



IMPORTANT NOTE: ALL EXTERIOR ELECTRICAL CONNECTIONS MUST BE INSTALLED AND PROTECTED BY NEMA LISTED EXTERIOR WEATHER TIGHT CONDUIT AND FITTINGS.

14) Run the airline into the riser. On installations where two White Knight towers are used, a tee and valves are required to divide and balance the airflow between the towers. When using ¾" piping for the main supply line make the transition at the tee to ½" to feed each tower.

15) Piping and any manifolds should be configured so, that if necessary, the tower is capable of being removed without causing damage to the air supply line that enters the riser.

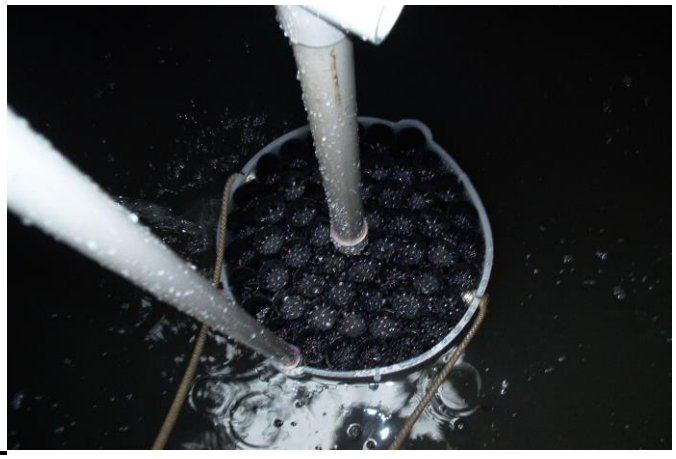
16) White Knight towers are manufactured to receive ½" ID Schedule 40 PVC pipe. A coupling is located at the top of the tower to one side for the air supply connection. PVC Solvent Weld Primer must be applied and PCV Solvent Weld Glue must be used. When gluing fittings together slowly twist the assembled components until a "set" can be felt.

The use of flexible piping between the tower and air line entry point in the riser is acceptable and may facilitate the placement of multiple towers through a single access opening. Threaded connections must be airtight and the use of a liquid Teflon pipe joint compound should be used.

17) With a length of airline connected to the tower lower the tower into place. For deep installations in may be necessary to place an extension onto the supplied lifting rope. Make sure that the tower of bucket platform, if necessary, is resting level on the bottom, stable and centered as close as possible in the tank compartment in which it is being installed but accessible from the service riser. Connect the air supply lines and secure the lift out line.

18) Activate the air pump and with the White Knight tower in place and refill the tank to normal operating level with clean water. Caution must be exercised for properties served by a well with regard to depleting the water supply. Always attain property owner permission to use their water supply. In situations where there is questionable well capacity water should be brought in to refill the tank.

DO NOT REFILL TANK WITH SEPTAGE FROM PUMPER TRUCK.



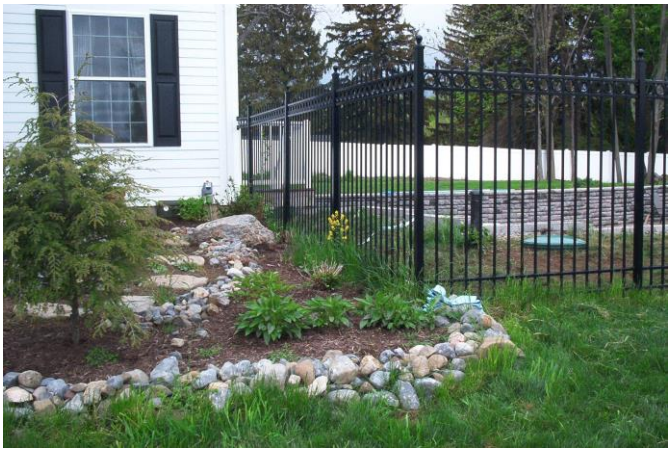
19) The IOS-500™ is placed into the system via a 3/4" PVC wand shipped with the unit that must be assembled. The wand is then inserted into the center of the tower's fixed film tubular media with the inoculant packet affixed. The coupling serves a dual purpose, as a stop to prevent the tapered end of the wand from coming into contact with the fine bubble diffuser located beneath and the method to attach the upper portion of the wand. The upper portion serves as the point of attachment for the IOS-500™ inoculating packet and is provided with a "Tee" fitting which facilitates wand placement, removal and allows for maximum circulation of the air lifted effluent throughout the tank. **The IOS-500™ inoculant must not be put into place until the system is active and the liquid level in the tank provides at least 2 ½" of cover over the top of the tower.**

20) Determine the amount of liquid that will cover the top of White Knight tower under normal operating conditions and adjust the inoculating wand so that the "Tee" of the wand protrudes 2" above the normal operating level of the wastewater.

21) Fix the inoculant packet to the wand just above the coupling using the provided plastic cable ties. Trim tie ends and insert the wand into the center of the White Knight up flow until the coupling makes contact with the top of the tubular media.

22) The airlift action of White Knight should display a rolling robust circulation pattern at the surface of the liquid above the tower without noticeable glugs or gurgles. Visible bubbles should be very small in size and typically no larger than a small pea. An erratic flow pattern, larger size bubbles and unusual sounds are indicators that an air leak is present or something is caught in the tower's media column interfering with the upward flow pattern and must be corrected. Debris may be cleared by inserting a ½" diameter pole or ridged plastic tube, with sharp edges broken, down through the tubular media repeating the process several times until the blockage breaks free.

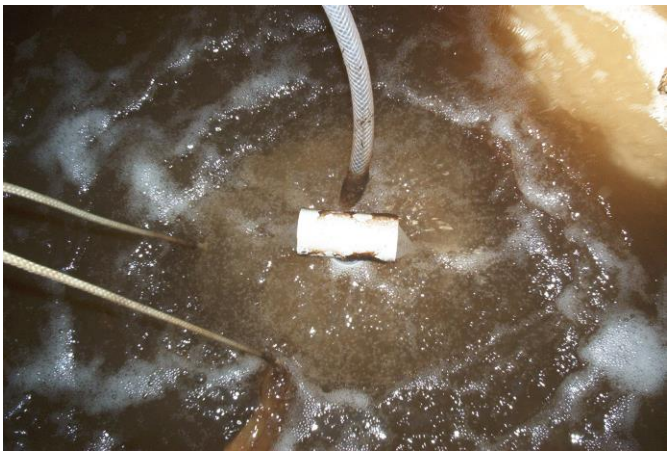
23) Secure all access covers and restore excavated areas. Review the Owner / Operator's Manual with the user and complete the White Knight Installation Registration Form provided with the unit.



24) Areas of the absorption system that had broken out and have untreated sewage exposed must be addressed. Apply lime to the affected area followed by a thin layer of topsoil, seed and mulch.

(VII) White Knight MIG™ Operation & Service

1) Routine service is conducted every 6 months through a maintenance contract with a factory certified and authorized provider. However approximately two weeks following the White Knight installation a follow up visit must be conducted by the installer and reinoculation performed. The second IOS-500™ inoculant packet that was shipped with the White Knight is used for this purpose.



Knight Treatment Systems, Inc. will notify each system's registered service provider 30 days in advance of a normal service visit. Following installation, routine service is conducted every 6 months with reinoculation occurring annually.

2) Upon removal of the wand the packet should exhibit brownish colored biofilms. These biofilms may also form on other system components. The bubble pattern should be robust and rolling, as it was when the unit was first activated.

3) Wearing proper personal protection equipment, remove the old inoculant packet from the wand, open it and empty its contents back into the tank. Do not throw the used inoculant sack back into the tank. Place the sack and the removed zip ties into empty the plastic bag that the replacement packet came in, carefully seal the bag and place this into another suitable container and dispose of with household trash. Affix new inoculant packet to the wand and reinsert the wand into the White Knight tower.

4) Effluent removed from the flow stream of the White Knight and placed into a clear container should be translucent and light in color with an appearance similar to that of "Lemon Aid" with no offensive odor.

5) As part of each service visit a ½" diameter pole or ridged plastic tube with sharp edges removed should be inserted down through the media column of the tower and the diffuser membrane gently bumped several times while in operation. Biofilms sometimes form on the membrane, which could reduce fine bubble production if allowed to build up. "Bumping" the diffuser breaks free any biofilms.

6) The effluent filter must also be checked. It should appear relatively free of undigested organic materials and will typically have light brownish biofilms on it. Inorganic materials should be removed and disposed of properly. Do not remove the beneficial biofilms.

7) Should extraordinary amounts of foaming be encountered it is typically caused by the over use of detergents or the use of high sudsing formulations. Spraying the foam with water from a garden hose will knock down the suds so that the system can be maintained.

8) Infrequent foaming events will not have a major impact on the overall performance of the White Knight but can cause nuisance concerns and trouble calls should the foaming become visible. The user must be made aware of the situation and corrective actions implemented.

9) The air pump's air filter must be removed and cleaned annually unless unusual dust conditions exist. The foam filter is easily cleaned by washing in a mild soap and water solution, rinsed and allowed to dry. Cleaning and rinse water should be disposed of at the inlet side of the tank.

10) The Absorption System should be inspected for sign of any breakout and its condition duly noted. Monitoring ports, if must be opened and depth of any liquid within recorded. Observe personal protection procedures and clean the measuring instruments with a disinfectant immediately following use.

11) Complete the Service Visit Report. Leave a copy with the client and file appropriately.

(VIII) White Knight MIG™ Service Visit Form

White Knight Microbial Inoculator/Generator™

Service Visit Record

Owner Name_____ **Unit Serial Number** _____

Date Visited _____ **Field Technician** _____

Purpose of Visit ___ Routine Maintenance ___Customer Concern ___ 2 Week Spot Check

Tank

Liquid appearance: ___Translucent ___Clear ___Other (specify)_____

Liquid odor: ___ None ___Perfumed ___ Noxious ___ Other (specify)_____

Bubble Pattern: ___Normal ___Abnormal (describe) _____

Unusual observations: _____

Effluent Filter: ___ In Place

___ Housing to outlet pipe secure

___ Cleaned ___ Hair / Lint buildup

Notes: _____

White Knight MIG™ Column: ___ Biological Growth Visible _____ Color

___ Ample flow through unit ___ Unit Clogged with _____

___ Inoculant replenished ___ Unit removed & cleaned

Notes: _____

_____

_____

Air Supply

Pump: Outdoor ____ Indoor ____ Hour Meter Reading _____

___ Pump Operating Properly ___ Air Filter Clean ___ Alarm Operating Properly

Notes: _____

Soil Absorption System

Weather: Precipitation previous 48 hrs _____ Time of inspection _____

Surface Condition: _____Dry & Firm _____Soft & Spongy

_____Saturated _____ Breakout / Location(s) _____

Monitoring Port: _____Inches deep from surface

_____ Dry _____Inches static water

Notes: _____

_____

_____

Repairs or Modifications Performed:

_____

_____

_____

Additional Comments:

_____

_____

_____

_____

_____Service Visit Report Left With Property Owner

Technician's Signature _____

(IX) RI Department of Environmental Management Design Requirements:

A. General

1. The White Knight Microbial Inoculator Generator™ is approved for the renovation of Individual Sewage Disposal Systems (ISDSs), which are organically clogged resulting in hydraulic failure, with an approved repair permit. The White Knight may also be installed in a properly functioning ISDS as well as a new ISDS, with an approved permit for new building construction.

2. The White Knight MIG™ is approved for all uses with no design flow restriction.

3. No reduction in required leach field area may be attributed to the use of the White Knight MIG™.

4. The White Knight MIG™ may not be installed in cesspools, block or steel tanks, or in substandard tanks.

5. In no case may the White Knight MIG™ be installed in a tank of a volume less than 1000 gallons.

6. Septic tanks in which the White Knight MIG™ is to be installed shall be equipped or retrofitted with a DEM approved effluent filter.

7. Since constant aeration is necessary for proper performance of the White Knight, the air pump must be operational 24 hours a day. To ensure owner/operator compliance all White Knight MIG's shall be equipped with an hour meter and a visible audible motor/power failure warning light, mounted on a NEMA approved cabinet on the exterior of the building.

8. System design shall be in strict conformance with the Rhode Island DEM approved White Knight MIG™ Design and Installation Manual and shall only be performed by appropriate DEM-licensed persons who are authorized in writing by Knight Treatment Systems, Inc. to do so.

9. System installation shall be in strict conformance with the Rhode Island DEM approved White Knight MIG™ Design and Installation Manual and shall only be performed by appropriate DEM-licensed persons who are authorized in writing by Knight Treatment Systems, Inc. to do so.

10. Each White Knight MIG™ installation shall meet other applicable DEM regulations and receive prior approval by the DEM pursuant to the regulations in effect at the time of the application.

B. Use With Existing ISDS

1. Before the DEM will allow use of the White Knight at a site, a Repair Application must be approved.

2. A copy of Knight Treatment Systems' Site Qualification Form and a copy of the originally approved plan or a system plan based on Knight treatment Systems' required site investigation, identifying location and size of tank, distribution box, if used, and the type and size of the leaching area in use, must be submitted with the ISDS Repair Application.

C. Incorporation in New Construction

1. Before the DEM will allow use of the White Knight MIG at a site, a New Building Construction Application must be submitted.

2. Only conventional and Class 1 I/A leach field technologies as referenced in the list of DEM approved proprietary I/A technologies are permitted for use with the White Knight MIG.